WHAT IS CLAIMED IS:

1. A fuel cell separator integrated into a fuel cell and forming a fluid flow path, comprising:

a separator base material having a surface; and

a metal coating layer formed from a metal and formed at least on the surface of the separator base material in a region of the separator associated with electrical contact resistance between the separator and an adjacent member of the fuel cell when the separator is brought into contact with the adjacent member when the separator is integrated into the fuel cell,

wherein the metal coating layer is formed from the metal that is successively subjected to melting and gradual cooling.

2. The separator according to claim 1, wherein the metal coating layer is formed after the surface of the separator base material is subjected to a predetermined treatment.

3. The separator according to claim 2, wherein after an underlying coating layer is formed on the surface of the separator base material as the predetermined treatment, the metal coating layer is formed on the underlying coating layer.

4. The separator according to claim 1, wherein the metal forming the metal coating layer is a metal having a lower melting point than that of a material of the separator base material.

5. The separator according to claim 1, wherein the metal coating layer formed from the metal contains a substance added to the metal which reduces a melting point of the metal when added to the metal.

6. The separator according to claim 1, wherein the metal is tin or a tin alloy.

7. The separator according to claim 1, wherein the metal is a tin alloy having a lower melting point than that of tin.

8. The separator according to claim 1, wherein

the metal is composed of a tin alloy, and

at least one of elements of the tin alloy other than tin has higher electrical conductivity in a form of an oxide than the electrical conductivity of tin oxide.

9. The separator according to claim 1, wherein the metal coating layer includes a plurality of electrically conductive particles.

10. The separator according to claim 1, wherein the metal coating layer has a corrosion-resistant coating layer formed on the surface of the metal coating layer, the corrosion-resistant coating layer being formed from a corrosion resistant, electrically conductive substance.

11. The separator according to claim 1, further comprising a carbon coating layer of a carbon material formed at least on the region of the separator base material where the metal coating layer is formed.

12. The separator according to claim 11, wherein, in addition to the region of the separator base material where the metal coating layer is formed, the carbon coating layer is further formed on a region forming the fluid flow path within the fuel cell.

13. A fuel cell separator integrated into a fuel cell and forming a fluid flow path, comprising:

a separator base material; and

a metal coating layer formed from a metal and formed at least on the surface of the separator base material in a region of the separator base material associated with an electrical contact resistance between the separator and an adjacent

member of the fuel cell when the separator is brought into contact with the adjacent member when the separator is integrated into the fuel cell,

wherein crystal grains of the metal forming the metal coating layer have an average grain size of 0.1 mm or more.

14. The separator according to claim 13, wherein the metal coating layer is formed after the surface of the separator base material is subjected to a predetermined treatment.

15. The separator according to claim 14, wherein after an underlying coating layer is formed on the surface of the separator base material as the predetermined treatment, the metal coating layer is formed on the underlying coating layer.

16. The separator according to claim 13, wherein the metal forming the metal coating layer is a metal having a lower melting point than that of a material of the separator base material.

17. The separator according to claim 13, wherein the metal coating layer formed from the metal contains a substance added to the metal which reduces a melting point of the metal when added to the metal.

18. The separator according to claim 13, wherein the metal is tin or a tin alloy.

19. The separator according to claim 13, wherein the metal is a tin alloy having a lower melting point than that of tin.

20. The separator according to claim 13, wherein

the metal is composed of a tin alloy, and

at least one of elements of the tin alloy other than tin has higher electrical conductivity in a form of an oxide than the electrical conductivity of tin oxide.

21. The separator according to claim 13, wherein the metal coating layer includes a plurality of electrically conductive particles.

22. The separator according to claim 13, wherein the metal coating layer has a corrosion-resistant coating layer formed on the surface of the metal coating layer, the corrosion-resistant coating layer being formed from a corrosion resistant, electrically conductive substance.

23. The separator according to claim 13, further comprising a carbon coating layer of a carbon material formed at least on the region of the separator base material where the metal coating layer is formed.

24. The separator according to claim 23, wherein, in addition to the region of the separator base material where the metal coating layer is formed, the carbon coating layer is further formed on a region forming the fluid flow path within the fuel cell.

25. A fuel cell, comprising:

a plurality of single cells stacked on each other,

wherein each of the plurality of single cells contains at least one separator for preventing a plurality of fluids supplied to the fuel cell including a fuel gas and an oxidized gas from being mixed with each other beyond a boundary between the single cells, and

further wherein each separator contained in each of the plurality of single cells is the separator according to claim 1.

26. A fuel cell, comprising:

a plurality of single cells stacked on each other,

wherein each of the plurality of single cells contains at least one separator for preventing a plurality of fluids supplied to the fuel cell including a fuel gas and an oxidized gas from being mixed with each other beyond a boundary between the single cells, and

further wherein each separator contained in each of the plurality of single cells is the separator according to claim 13.

27. A method for manufacturing a fuel cell separator integrated into a fuel cell and forming a fluid flow path, comprising steps of:

forming a layer of a molten metal at least on a partial region of a separator base material forming the fuel cell separator; and

gradually cooling and solidifying the layer of the molten metal formed in the forming step so as to form a metal coating layer.

28. The method according to claim 27, wherein the forming molten metal layer step is the step of forming the molten metal layer after a surface of the separator base material is subjected to a predetermined treatment.

29. The method according to claim 28, further comprising a step of, prior to the forming molten metal layer step, forming an underlying coating layer on the separator base material, wherein the forming molten metal layer step forms the molten metal layer on the underlying coating layer.

30. The method according to claim 27, wherein the layer of the molten metal formed in the forming molten metal layer step further includes a plurality of electrically conductive particles in addition to the molten metal.

31. The method according to claim 27, wherein the gradual cooling is conducted at such a rate that crystal grains of the metal forming the metal coating layer have an average grain size of 0.1 mm or more.

32. The method according to claim 27, further comprising a step of forming a corrosion-resistant coating layer of a corrosion-resistant, electrically conductive substance on the metal coating layer.

33. The method according to claim 32, further comprising a step of forming a carbon coating layer of a carbon material on the corrosion-resistant coating layer.

34. The method according to claim 27, further comprising a step of forming a carbon coating layer of a carbon material on the metal coating layer.

35. A method for manufacturing a fuel cell separator integrated into a fuel cell and forming a fluid flow path, comprising steps of:

forming a plating layer of a metal at least on a partial region of a separator base material forming the fuel cell separator;

melting the metal forming the plating layer at a temperature equal to or lower than a melting point of the separator base material; and

gradually cooling and solidifying the metal melted in the melting step so as to form a metal coating layer.

36. The method according to claim 35, wherein the forming plating layer step is the step of forming the plating layer after a surface of the separator base material is subjected to a predetermined treatment.

37. The method according to claim 35, further comprising a step of, prior to the forming plating layer step, forming an underlying coating layer on the separator base material, wherein the forming plating layer step forms the plating layer on the underlying coating layer.

38. The method according to claim 35, wherein the plating layer formed in the forming plating layer step further includes a plurality of electrically conductive particles in addition to the metal.

39. The method according to claim 35, wherein the gradual cooling is conducted at such a rate that crystal grains of the metal forming the metal coating layer have an average grain size of 0.1 mm or more.

40. The method according to claim 35, further comprising a step of forming a corrosion-resistant coating layer of a corrosion-resistant, electrically conductive substance on the metal coating layer.

41. The method according to claim 40, further comprising a step of forming a carbon coating layer of a carbon material on the corrosion-resistant coating layer.

42. The method according to claim 35, further comprising a step of forming a carbon coating layer of a carbon material on the metal coating layer.